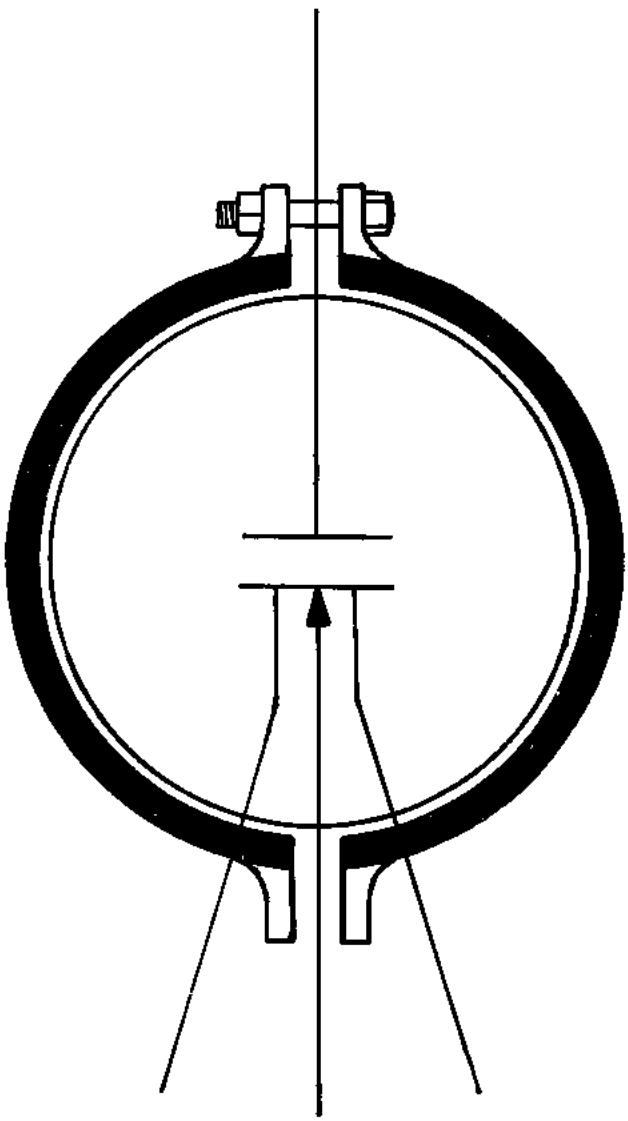
# NONLOQUI 1970



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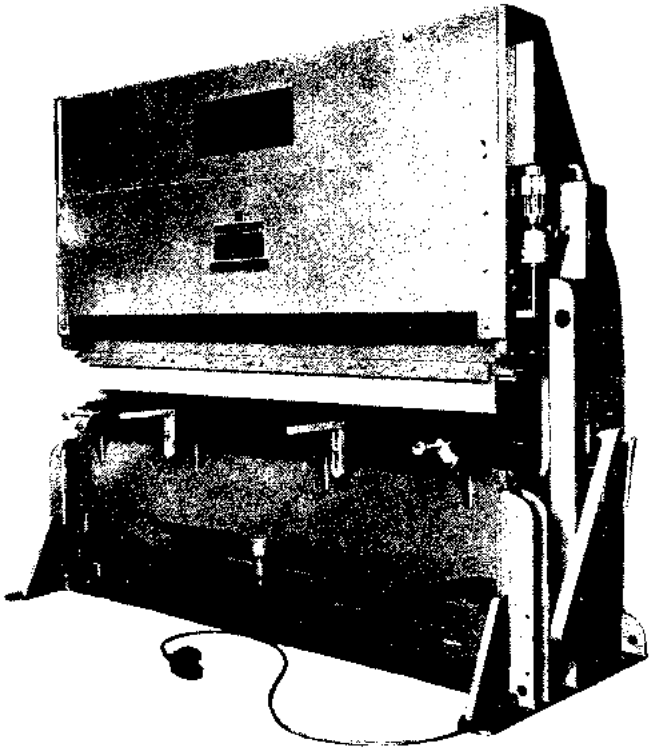

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THE HYDRABEND
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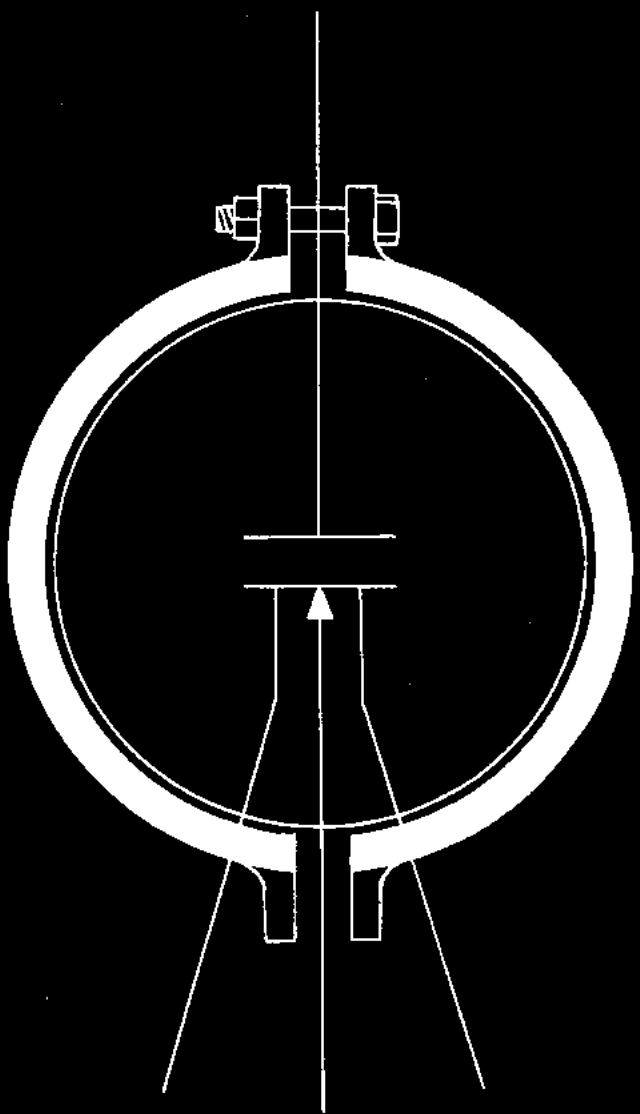
# NONLOQUI 1970

Official Magazine of the University of Western Australia Engineers Club



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# PRESIDENT'S REPORT

1970 was marked by both a revival of club spirit and a consolidation of club finances.

The main reason for this was the participation in club activities, both sporting and social, by a large number of first year students. If this trend can continue, the club will only go from strength to strength and continue to dominate the campus as in past years.

Though runners-up this year in Goyder Cup, a real effort must be made by every member to enable the club to win the competition previously dominated by Engineers.

This year saw the Science and Engineering Exhibition take a new name and structure as the University Exhibition. As in previous years, it was of a high standard, with the Engineering displays being largely responsible for its success.

I would like to take this opportunity to thank the Social Committee, whose efforts were reflected by the outstanding success of the Ball and Dinner – both very well attended.

The club's success this year has been due in no small part to the willing assistance offered by the committee and the enthusiasm imparted by them to the club as a whole. I hope that this spirit will prevail in the incoming committee, and I wish the club every success in years to come.

RON SPENCE

# 50 YEARS A CLUB

When the Engineering School was shifted to Shenton's Villa in 1914 from Irwin Street, the very isolation and inaccessibility of the site formed a strong bond between Engineering students.

The war intervened and many students saw active service - five dying in the service of their country. After the war, the students, affected by the dance craze, held many small shows in lecture rooms and drawing offices. The success of these dances led to the Engineers' Ball of 1919.

The growth of this function finally necessitated the formation of a formal club. At a meeting of the Crawley Undergraduates on 8 September 1921, Mr. Morrison moved that 'a Club be formed called the D.B.A.' This club one year later became officially the University Engineers' Club.

In 1927 the club received a boost with the opening of the Engineering Hall. Now not only could the club hold its Ball at Crawley but also two common rooms were allotted for the Club's use.

The present Engineers' Crest originally created as a decoration for the 1930 Ball to hide a hidious clock at the North end of the hall. The meeting at which Mr. Hearder described the proposed crest was thrown into uproar when informed of the intended outline of a bottle to be included. Several members were silenced only when the undertaking was put as a motion and passed. Two Civil students, Munro and Manners, were assigned the task of painting the design, which on completion received State wide acclaim.

That same year saw also the acceptance of Mr. Gillespie's proposal that Engineering freshmen be initiated.

The faculties joined the Engineers at Crawley in 1932. The result of this was a sudden upsurge in inter faculty rivalry. The Engineers had their crest embroidered upon a banner, which immediately became the object of envy of the Science Union who possessed only a red and green rag. Marching under this rag, the S.U. engaged the Engineers in battle, only to be defeated and lose their own banner.

Several Science students, posing as Engineers, conned the President's landlady into handing over the Engineers' banner. A truce followed and the banners were exchanged.

At the Graduation ceremony in 1942, the S.U. displayed its banner surrounded by a massive bodyguard. As they entered Winthrop Hall, an Engineer located above on a balcony hooked the banner up with a fishing line. The banner was relayed by runners strategically placed between Winthrop Hall and Engineering and locked away in the Professor's safe.

The S.U. banner was almost lost when at a 'battle' in the Sunken Garden possession alternated between Science students and Engineers. The Engineers retained 80% of the S.U. banner and used it at a foot-wiping ceremony the following Friday. The remaining shred is now fixed to the Engineers' banner preserved in the Professor's safe.

In 1933, Mr. Goyder presented a cup for inter-faculty competition. The Engineers held this cup from this date until 1957, when it was given to the club. The competition (under new rules) was rejuvenated in 1962, and although not as successful as before the Engineers have always figured prominently.

The club has always participated in Graduation stunts, but these were forcefully terminated following the 1954 ceremony. Several first year Engineers carried seven sheep into Winthrop Hall before the ceremony and caused such an outcry that students were not invited the following year and the Hall was guarded as closely as an American Embassy.

The first Engineering Exhibition was held in 1956, and because of its success it was made a biennial event. This year the Exhibition covered the whole campus as the University Exhibition, but still relied heavily on the Engineering displays.

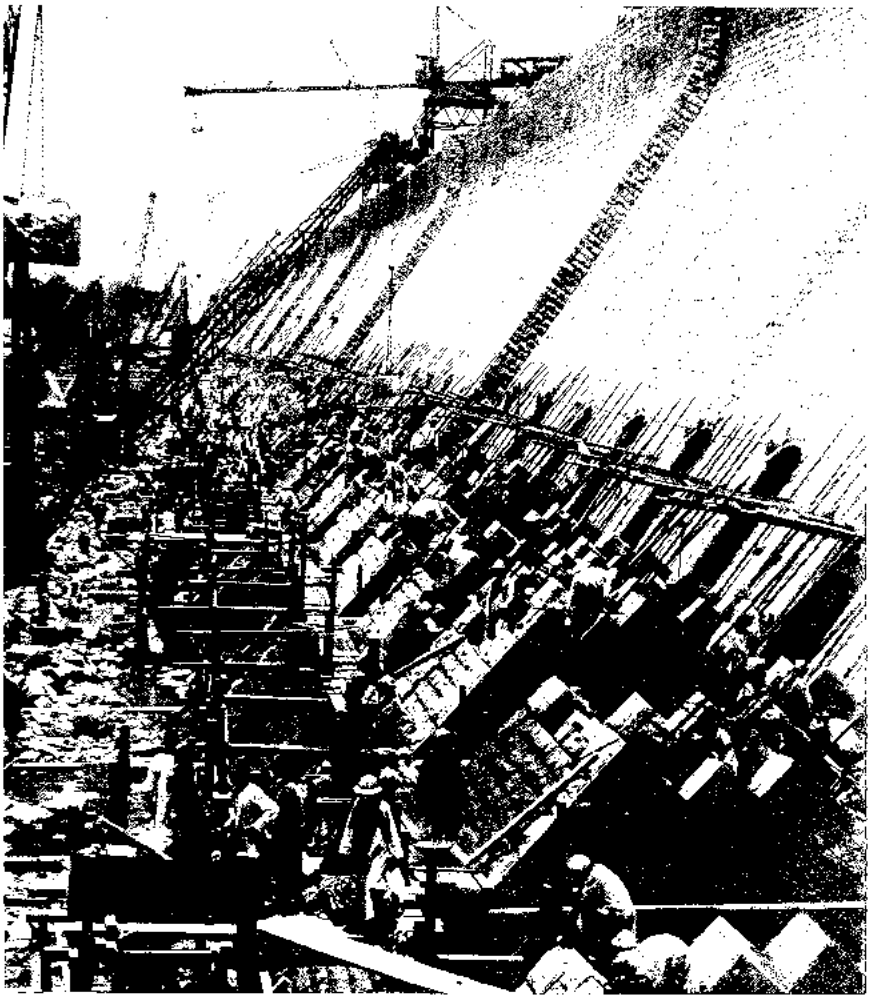
The inaugural Tug of War was held in 1958 against Medicine. Although we have never lost the tug, the R.U. Pulling trophy lies in the Lawyers' citadel, whisked away under a barrage of cannon fire and flour bombs from the Engineers.

1961 saw the opening of the present Engineering buildings and the club holding its first Symposium. The Engineers also introduced the Inter-Faculty Bath Tub Race and U.E.C. News.

The years following saw changes in the club, both in size and structure. The old five-year course was dropped and a high pressure four-year course introduced. The Club doubled in size in a decade and a building designed for 400 students had to cope with half that number again. Classes were split and club spirit dropped to the post-war level.

This year has seen a revival of that spirit emanating, surprisingly, from the freshers, who held several successful rallies against the Law buildings, supported the Club in Goyder Cup, and strengthened the Club financially by attending the shows. Through such participation, it is hoped Club traditions will survive and continue to provide a proud record for future Engineers.

**CHRIS FITZHARDINGE**



# ASWAN DAM

C. CRISAFULLI

At the beginning of the first cataract of the river Nile, 3½ miles above the town of Aswan, in Egypt, the Aswan Dam bears witness to the boldness of early 20th century engineering. Once one of the largest dams in the world, it has stood the test of time, holding back at any one time as much as 5,300 million cubic meters of flood water.

The original dam was completed in 1902, at a time when reinforced concrete was virtually unknown as a structural material, and in a country whose technology was by no means advanced. So the engineers involved in the project were both pioneers and gamblers, and the people of Egypt and Northern Sudan are indebted to them in no small way.

Today, the Aswan dam stands 124.6 feet above its foundations and runs for a length of 7,062 feet; nearly 1½ miles. The 100 ft. thick base tapers to 36 ft. at the top, and on the downstream face sturdy concrete and granite buttresses support the brunt of the load. All along its length there are a total of 180 sluices which together can pass almost the entire Nile flood without check; permitting the heavy load of silt to continue on downstream. When the dam is full it converts the Nile for 150 miles upstream into a vast lake, and together with the smaller Jabal at Mwliya dam, it enables an immense area of once useless semi-desert in Middle and Lower Egypt to be irrigated and used for summer cultivation. At the Western end of the wall a lock allows the small river craft to negotiate the change in water level.

Since it was first commissioned, the Aswan dam has three times been subject to extensive modernisation. It was first heightened between 1907-1912, and then again in 1929-1934. More recently, in early 1960, it was adapted to producing hydroelectricity, and the inauguration of the large power station the first of its kind on the Nile -- set off an industrial revolution in the area: on the same day, a large Nitrate plant went into production just North of Aswan.

The heightening of the dam presented many problems. At the time of construction, unlike today, concrete was considered to possess no aesthetic qualities of its own. For this, and other reasons, it was decided to make the outer faces of the dam wall out of rough-hewn granite. Material wasn't lacking, since the surrounding hills were all solid granite.

Enormous boulders were blasted out of the rock faces with dynamite: the rest was done by hand. The boulders first had to be cut down to to size. This was done by skilled stone-masons imported from Italy, who with uncanny exactness would hammer wedges into the rock so that a slab of granite of just the correct thickness fell away. This was then chiselled into large building blocks about 4 ft. x 2 ft. x 2 ft.

Fortunately, at that time in Egypt labour was very readily available at cheap rates, since the only form of mechanisation available was several large cranes, used principally to place the granite blocks in position. Working conditions were totally unacceptable by modern day standards, most of the work being done in well above century heat. Still the job was completed, in no way hampered by discontent amongst the workers.

Increasing the wall height naturally resulted in a much larger volume of water in the reservoir and a corresponding build up of pressure on the dam wall. To cater for this increase, about 400 buttresses, 10 feet wide, were built on the downstream side of the wall, from ground level to the top of the existing wall. The original wall surface had been purposely made rough and undulating to add beauty to the dam. However, the engineers required that the buttresses rest on a smooth surface. This posed a problem which was obviated by having a large labour force: the granite was chiselled smooth by hand. The men stood on rigs similar to those used by painters on multi-storey buildings, and lowered themselves down the face of the wall as they worked.

The construction of the buttresses was carried out in the same manner as the rest of the wall: concrete was poured into a shell of granite blocks, which also acted as formwork. First of all, nine two-inch diameter steel reinforcing rods were placed in position for each buttress, in about 40 ft. lengths. Half-inch thick steel plates were then layed at the interface of the wall and the buttresses, so that the two were not actually bonded together at the completion of the job: this allowed for a small amount of relative deflection. Finally, the outside wall was built up a short way with granite blocks and concrete was poured into hollow, around the reinforcement.

The concrete used on this project was quite unlike anything one would find at an ordinary site. Because of the vast volume which had to be filled, the aggregate was made up of rocks ranging from the size of a man's head to pebbles 3 or 4 inches in diameter.

When the wall itself was being heightened, the reinforcing rods had to be driven to the very bottom of the existing wall. Apart from this, the procedure was as for the buttresses. In this way, a few feet at a time, the Aswan dam reached its final proportions about 35 years after construction originally started.

Now that the dam was finally completed and the water level began to rise, the disapproving voices of historians and archaeologists the world over began to make themselves heard. The area surrounding Aswan is rich in monuments and buildings which date back to the days of the early Pharoahs. It soon became obvious that many of these would be partially or totally submerged when the dam was full. However, this was accepted by many as being the price of progress. It wasn't till quite recently that anything positive was done towards ameliorating the situation. In 1963, an international group of engineers and archaeologists, sponsored by the United Nations, tackeld the colossal problem of salvaging two of Ancient Egypt's most famous monuments: the Great and Small Temples, built by Rameses II 3,200 years earlier at Abu Simbel, 175 miles South-West of Aswan. The task was completed on September 22nd, 1968, after some of the most modern engineering techniques and an equal amount of initiative had been used to shift the temples from their watery foundations to a plateau 200 ft higher up – just 12 ft. above high water mark.

As a result of the success of this operation, a second expedition set out in 1967 to save the beautiful temple of Isis on the island of Philae, which up to that time had been submerged for nine months of the year.

Today the Aswan dam is no longer the largest in Egypt. Just five miles upstream the gigantic Aswan High Dam dwarfs the old dam to insignificance. 436 feet high and over two and a half miles long, it is one of the largest in the world. When full, it is estimated to have a capactiy of 130,000 million cubic metres, and it impounds water for 367 miles upstream, submerging an area of about 2,000 square miles.

The High Dam was originally to be built with British and American aid, but when these countries withdrew their help in 1956 the late Gamel Abdel Nasser declared that Egupt would go on with the project. Soon after he accepted Soviet help, and in January 1960 he detonated eleven tons of dynamite to mark the commencement of construction. Since that day the project has been beset with problems, not the least of which has been the need to transfer 90,000 Egyptian and Sudanese peasants from their homes to new settlements away from the reservoir.

So even now, 68 years after its first commissioning, the old Aswan Dam is still a very valuable asset to Egypt, and will probably remain so even after the High Dam is eventually completed.

# SYMPOSIUM ADELAIDE

Eight intrepid travellers from W.A. ventured across the Nullabor to attend the 1970 A.N.E.S.A. Symposium in Adelaide. Various modes of transport were used; the reliable train being preffered by four, three braved the desert in a Cortina, while the remaining one travelled in first class comfort by air - courtesy of the Government

By Sunday afternoon everyone had arrived, and after a few unofficial sightseeing trips and having sampled the local lager we were ready to take part in the Symposium proper. A symposium, quoting from the Oxford dictionary, is 'A convivial meeting for drinking, conversation and intellectual entertainment'. Eight eminent speakers provided the intellectual entertainment, with a series of papers around the central theme 'The Status of Engineers'. Adequate time was allowed at the end of each talk for those of us who were interested enough to take part in a discussion with the speaker and each other.

We were all accommodated at the Arkaba Hotel, about two miles from the city, and here was held an informal welcome for all the interstate visitors. A merry night was had by all, and in just 2½ hours 800 jugs of non-intoxicating lager were consumed. A vast crowd from Sydney was the centre of attention, with whole jugs being demolished in very quick time, until a danseuse of large proportions came to entertain us by disrobing on the table-tops. This rowdy Sydney mob, not content merely to display their own abdominal fortitude, called for challengers from other establishments. At one stage during the proceedings a pint of lager found its way into Mike Walters' hair seemingly because his opponent had no more room in his stomach. Fortunately, we had only a few yards to go to our rooms, whereupon we consumed a few bottles for a night-cap.

Strangely enough, a large crowd managed to show up at the Uni to hear the official opening by the Speaker of the House of Assembly, the Hon. T.C. Stott, who gave a paper on 'The Status of the Engineer in Politics'. Lively discussion followed, only to be concluded so that some of us could attend the official luncheon. However, numbers diminished drastically at the afternoon talk on 'The Status of the Engineer in Industrial Affairs' by the Executive Director of A.P.E.A. Mr. J.A. Michael.

The Cabaret held at the Hotel Australia, North Adelaide, that night was extremely successful, and with the female-male ratio of 3:1, a few interesting aquaintances were made. Special mention must be made on this point for Rod on having the most 'unusual' bird of the week. It was an extremely lively evening, with $1,000 worth of beer and spirits being consumed by 11.30 pm. At the conclusion of the evening, everyone departed for destinations unknown, and most were not seen until the next afternoon.

Understandably, perhaps, Tuesday's paper on 'The Status of the Engineer in International Affairs' by Prof. Moorhouse, University of Melbourne, was very poorly attended. However, by one o'clock almost everyone was on the train to the Barossa Valley. Our thirst for beer revived, several cans were consumed on the trip up. We were treated to tours of several wineries, the greater part of the time being spent in the tasting rooms, so it was quite a gay crowd which arrived at Angaston for the evening's entertainment. This consisted of a smorgasbord tea, about 200 gallons of beer, and about an equivalent number of girls. A mediocre band supplied music, which happened to be in season in S.A.

The trip back to Adelaide was reasonably quiet, with most of the carriage lights being removed from their sockets, with those who were not paired up with one of the other sex demolishing the remainder of the wine which had been purchased quite cheaply. Once again, nearly everyone went missing until the next afternoon.

Wednesday morning's talk was even more exclusive, on 'The Status of the Engineer in the Community' by the Vice-Chancellor of La Trobe University. However, the tours arranged for the afternoon were quite well attended, especially the one to the S.A. Brewery. Other tours included Chrysler's Valiant production plant, an oil refinery, power station, a ship building yard, and Phillips' new I.C. production plant. There was nothing organised for the evening, and most of us took the opportunity to get a few hours of much needed sleep.

Thursday morning Mr. W.W. Sweetland, Executive Manager of Technology, B.H.P. gave a talk of 'The Status of the Engineer in Industry', and the afternoon was occupied by a paper on 'The Status of the Engineer as a Consultant' by Mr. P.J. Fargher, a local consulting engineer.

The highlight of the week was undoubtedly the Symposium Ball, held at the Arkaba Top Room. This is a circular room with a pagoda roof, and virtually no decorations were needed to supplement it. Two bands performed alternately until about 10.30, when a superb supper was served. At this point a third band was added to the line-up, and thus we were not short of entertainment. One of these, a German group known as the 'Bavarians' got everyone moving on the floor right from the start, and it was an exhausted crowd that left at about 1.00 a.m.

Here, several post-ball parties were held, one of which lasted twelve hours. Others continued at the University, and several dinner suits and ball gowns were seen at the Friday morning talk. This was given by Mr. A.R. Arthur, of P.A. Management Consultants, on 'The Status of the Engineer in Management'. The final paper, presented by Mr. A.K. Johinke, Commissioner of Highways, S.A., was held on a very lively note for the pleasure of those who managed to attend.

To round up an excellent Symposium, a males-only Dinner was held, also at the Arkaba Top Room. As the excellent meal was finished, the show started to degenerate somewhat. Old songs from the various engineers' song books were sung with gusto, and some unknown advocate of SCIIAES gave a brilliant recital of 'Eskimo Nell'. However, it seemed to be different from the usual Bucks' show and no-one got out-of-hand. The leader of the 'Bavarians' got into the spirit of things and challenged the Sydney drinking champion to a jug. He refereed the annual boat races, during which Adelaide Uni were narrowly defeated by Sydney. Rowing certificates were also presented to those who managed to down five 15 oz. glasses in five minutes and retain their contents for a further five. Needless to say, very few were won.

So Saturday saw the end of a very soggy week for engineers in Australia. Half of the band from the West decided it was time to come back home to recover, while the other half went further East to find peace in new surroundings. I strongly advise you to try and get to Melbourne for next year's edition of this worthy event.

**M. BURR**

# GLEDDEN TOUR

On the evening of Saturday the 21st of November the train pulled out of East Perth station carrying with it the 21 members of the 1970 Gledden Tour. Everybody soon settled down to a pleasant evening of drinking in the club car. Within five minutes Geoff Cocks had conned a bird, a practice he was to continue for the rest of the tour.

John Modra was the first 'cot case' of the tour catching a gut wog on the train and missing the welcoming evening held by B.H.P. at Whyalla, the inspection of the Basic Oxygen Steel plant, and the tour of the heavy and medium machine shops. The next tour was to Iron Knob, which was very interesting, but on a much smaller scale than the projects in our North West.

A short plane trip took us to Adelaide, Geoff Cocks commenced conning the hosties even before take off. The trip to Chrysler was interesting but spoiled a little by the guides who must have mistaken us for primary school students. In contrast the guides at the Weapons Research Establishement must have mistaken us for secret agents - no cameras and no straying from the official party. The standard answer to most question was 'I'm sorry but I can't tell you that.'

On the train to Melbourne Geoff Cocks conned some gaol bait. We booked into the Federal Hotel for our stay in Melbourne - easily the scungiest Hotel of the whole tour. This building has been described in a recent copy of 'The Bulletin' as 'marvellously monstrous'.

On the way to the Aeronautical Research Laboratories at Fishermans Bend we passed the Westgate Bridge - much to the discomfort of the Civils! Hushed silence and grating of teeth.

Leaving Melbourne by Coach we headed towards the Snowy Mountains. Scarcely had we booked into the Motel at Lakes Entrance than Geoff Cocks conned another bird!! The next three days we spent in touring the most important projects in the snowy scheme. Perhaps the most memorable was the Tumut 2 underground power station. On the second day we went to Thredbo and ascended in the ski lift to where some compacted snow still remained. All went 'ski-ing' in their shoes except Manohara who starred in bare feet!

On the way to Canberra we called in to Tidbiubilla Deep Space Communications Complex. Doctor John felt that the name was redundant because he was sure that Tidbiubilla was actually the aboriginal word for Deep Space Communications Complex.

Everybody thought Canberra was very pretty. Unfortunately we missed an opportunity to abuse John Grey. So we ignored him.

International House at the University of Sydney was our home during our stay in the big smoke. Those of the group who did not see Hair on the first night in Sydney saw it on the second. Tony Kay checked prices with certain females standing around in the Cross. He assures us that that was as far as he went. The most interesting visits during our stay in Sydney were to the Opera House, the Nuclear Reactor at Lucas Heights the numerically controlled Machine Tools at Lane Cove Engineering and the high rise buildings under construction at various places in the City. The highlight on the social side was an evening at the Hoffbrau House in the Cross, organised by Graham Ferrero. That evening all twenty of us conned birds. Cocks was not alone.

On the way back to Perth we called in to Broken Hill and spent an interesting evening haranguing the local yokels from the safety of the Astra Hotel balcony. The next day we toured the mines and learned why it is called the Silver City.

The evening before arriving back in Perth the group made a presentation to Dr. John Fall to thank him for the effort he put into organising the tour. It was undoubtedly a great success and all the credit must go to Doctor John.

AWARDS:

Chester Burton - most prominent 'character'.

Despite early bowel trouble Chester was the most consistent 'character'. Removed his shoes and socks and sat on the pavement when and where he wanted to. It is rumoured that Chester did not move his bowels until reaching Sydney.-- A whole three weeks!!

Bob Harvey - best clothes.

Everybody just loved Bob's blue night dress.

Doctor John - best shaped gut.

Growing daily on a diet of cigars and double Scotches.

Bill Fung - most consistent gambler.

Gambled constantly - lost consistently.

Foong - takes the demolition award.

His specialty was breaking wash basins at hotels.

John Modra - nicknamed the Gledden Bolter.

It was suggested that the speed with which meals were consumed was the main reason for him catching the gut wog on the train.

Geoff Cocks - award for astonishing virtuosity at conning birds.

Virtuosity with no concern for virtue.

Chia - award for most fluent Chinese.

Still requires interpreter after 4 years in Australia.

Mike Leung - award for Medical Research.

Takes 'Australian medicine' to cure an illness then 'chinese medicine' to make him feel better. Work that one out.

# POSTGRADUATE RESEARCH

# ELECTRICAL & MECHANICAL

**Adaptive Optimization of Systems using Computer Techniques.**

The main goal of the research program is a study of adaptive strategies with particular emphasis on their application to self-optimizing and learning control systems. In general humans outshine the automatic system with their huge capacity for open-loop or programmed control, but they lack the speed and reliability for making on-line computations needed in the operation of an active system in a changing enviroment. The rapid change in vehicle characteristics in high performance aircraft, which may climb from sea level to extremely high altitudes in minutes, requires an automatic adaptive system to relieve the burden on the pilot. The optimization of an ore processing plant to obtain higher yields and economic gains is a complex dynamic task which requires the continious monitoring and control of a large number of parameters to enable adaption to changes in crude ore quality and plant characteristics.

The main tool being developed for the research program is a sophisticated hybrid computer link which interfaces a PDP-6 digital computer and an Applied Dynamics AD-32. The link enables program control of the analogue computer and rapid data transfer between the two computers. Though the hybrid link is primarily a tool, it is also a good example of the hardware required to integrate a digital control computer in a real analogue plant.

Concurrently with the development of the hybrid link, a theory of 'Optimal Curve Fitting with Piecewise-Linear Functions' has been developed. The theory has been applied to the design of a programmable diode function generator for the hybrid computer and utilized in the development of a program for calculating the transient response of a system from its frequency response.

A. CANTONI

**Silicon Arrays**

With the advent of silicon planar technology, intense interest has been shown, especially in recent years in integrated image sensors contained on a single chip of silicon. An integrated sensor has a number of advantages over vacuum tube types (indicons, orthocons, etc.); namely, low cost, low voltage requirements, compatability with other semiconductor circuitry, small size and simplicity, higher sensitivity, and virtually infinite life.

The individual sensors in an array may be photodiodes or phototransistors operated as photelectric current generators, or in a photon flux integration mode. Sampling of each sensor is performed by an integral array of diodes or MOSFETS (one per sensor) interconnected by a crossed grid so that when a signal is applied to two perpendicular lines of the grid, the output signal represents the light level at the sensor located at the intersection of the two lines. Signal lines are selected by integrated shift registers of decoders located at the sides of the array. With all these elements located on one chip a television camera is reduced to a box with a lens and array, requiring one or more low voltage supplies and a synchronising pulse source, yielding T.V. signal and frame and line pulses.

Large arrays suitable for use in commercial television have their special problems, and initial work is being concentrated on producing a small size array to be used as a workhorse to solve these problems. The solutions that are found will be directed towards producing a medium resolution array that would be suitable for use as a videophone. Other work will be directed toward as yet untouched subjects, such as random sampling of an array which could provide T.V. bandwidth compression researchers with a new tool in their research.

C. LEWIS.

## Effect of Gold on Surface State Charge of MOS Systems.

One of the principal applications of introduction of gold into silicon devices has been in the control of minority carrier lifetime. More recently, interest has been centred on the effect of gold at the oxidised silicon surfaces and its effect on the electrical properties of MOSFETs. It has been observed that the turn on gate voltage of the MOSFET shifts to positive values when the gold is diffused into the silicon substrate of the MOSFET. The location of gold near the oxide-silicon interface producing the positive shift of the turn on voltage is in question. For example, gold can be accumulated at the surface space charge region of the silicon or, negatively charged gold ions can accumulate in the oxide, near the oxide-silicon interface.

The group is engaged in making the MOSFET devices and the aim of the project is to investigate the mechanism of gold in silicon producting the shift of the turn on voltage.

M.E. SPROUL

## Ion Implantation in Semiconductor Films

Interest in ion implantation commenced in the early 1950's with a patent filed by W. Shockley, who saw the possibility of implanting dopants into semiconductors. The first practical device made by ion implantation was reported in 1962, and since then the involvement of industries and research groups around the world has led to the production of high speed MOS circuits.

Investigations into the doping of compound semiconductors to create pn-junctions where conventional chemical doping failed and into the optical properties of implantation doped materials are proceeding at many research centres.

The implantation of a variety of dopants into a substrate requires a flexible ion source. A spultered ion gun capable of producing a large variety of ions has been developed at Harwell by the I.K. Atomic Energy Authority, and together with a 30kV accelerator forms the basis of the implantation equipment.

The Harwell source uses argon as a support gas to spulter the dopant from its source material and initial investigation into the effect of argon damage on the substrate must be performed before it is decided if magnetic separation of the ion beam into its constituents is necessary.

Satisfactory operation of the implantation equipment will then lead to the study of the cathodoluminescence of CdS doped with several materials over a range of dopant densities.

C.A. MAYNARD

## Cadmium Sulphide Thin Films.

In investigations of the properties of various thin film devices an interesting phenomenon, differential negative resistance was found in certain metal–CdS–metal sandwich structures. These structures are made by evaporation under vacuum conditions of the various materials in the proper sequence through a number of metal aperture masks.

At a first attempt to correlate the properties of the device it was found that there is a definite correlation between the thickness of the CdS layer and the onset of negative resistance and there is a definite deposition temperature for the CdS above which the devices exhibit symmetrical properties and below which they are non-symmetrical. In the symmetrical version of the device both contacts for Schottky barriers to the CdS, while in the non-symmetrical case the top contact forms an ohmic contact.

E. JOHANSEN

## Technology and Applications of Thin CdS Films

Cadmium sulphide is one of the most optically sensitive semi-conductors used today. It finds common application in photovoltiac cells, where light energy is converted directly into electrical energy, and in photoconductive devices, where properties such as resistance vary with the intensity of illumination. The semiconductor used in these devices is usually single crystal material, so there will be considerable differences in properties then polycrystalline films of cadmium sulphide are used. The optical properties of interest to the Thin Film Group are the open circuit photovoltage and the photoconductive effects, and not the properties and techniques associated with the manufacture of power generating cadmium sulphide cells.

One particular device of interest has a position sensitive characteristic where the voltage output depends on the distribution of light intensity on the active region of the device. Such a device, with an output characteristic which changes sign as a spot or line of light passes through a balanced position, has practical application in the fields of pure optics, metrology, industrial instrumentation and automatic control.

The devices so far fabricated have voltage outputs far in excess of other recorded outputs, and so current research is aimed at optimizing the manufacturing process to produce devices of high reliability with consistant parameters. This is being accomplished by a theoretical approach to the device mechanism so the significant parameters can be recognized, and by a careful study of the semiconductor materials and their techniques of deposition to form the devices.

R. MALYNIAK

**Matched Coding of Differentially Quantized Television Signals.**

Digital data transmission has the inherent property of high noise immunity and may be used for good quality transmission through mediocre channels or over long distances. However, to digitize a standard television signal to 128 levels and transmit via a 'Pulse Code Modulated' (PCM) system would demand a large bandwidth ( 80mHz) channel. A worthwhile improvement (30mHz bandwidth) has been found possible with weighted quantization of essentially the difference between adjacent picture elements. This 'Differential Quantizarion' utilises a property of the human eye (the ultimate receiver) that allows gross errors in the representation of sharp changes in contrast to go unnoticed.

My research project involves the computer simulation of a Differential Quantizer with a view to devising suitable coding techniques to attempt to match the statistics of the source and produce a further reduction in the bandwidth requirement. The simulation demands the collection of the full information contained in one picture ($3.2 \times 10^5$ distinct elements/picture) to a high degree of accuracy. To achieve this a versatile data link between a Television Flying Spot Scanner and the PDP-6 Digital Computer has been designed and built. This allows the computer to request the intensity information of any element in the picture, simply by specifying the X,Y coordinate of that element. A method of multiple sampling in the presence of random perturbations has been devised to increase the data accuracy from 16 levels to at least 128 levels.

This low noise data is then used as the video source for various simulation programs on the digital computer.

R.R. PERRY

**Discontinuous Control Systems.**

The need to characterize a process or system in engineering is a central requirement for a deep understanding of the process or in any effort to improve its performance. In electrical-engineering terminology, we are concerned with the identification problem, the problem of identifying process dynamics in usable terms, such as a differential equation or a transfer function. The identification problem is of even greater importance in the general field of adaptive control systems. The majority of the reported work has been predominantly concerned with the case of linear systems. Little has been achieved in the identification of nonlinear systems. The present research is aimed to identify some simple nonlinear systems using pseudorandom signals. Despite the extensive research in the properties and the applications of pseudorandom signals in the last decade, the importance of their application in nonlinear systems is only realised in the last few years.

A. YUEN

**Thin Semiconductor Film Active Devices.**

In a study of the conduction mechanisms in Metal-polycrystalline Cadmium Suplhide-Metal structures, several interesting anomalous conduction effect have been observed. Further experimentation has been carried out to determine the cause and properties of these conduction anomalies.

In the Cu-CdS-Cu (or Au,In) structure switching and memory effects have been exhibited, similar to those observed in chalcogenide-glasses and transetion-metal compounds. Electrothermal effects, namely structural or compositional phase changes in the material and current filaments have been proposed as mechanisms which cause switching and memory effects in chalcogenide glasses. Experimentation has revealed, that because of the method of deposition of CdS – coevaporation of Cadmium and Sulphur -- the sulphur vapour will react with the bottom Copper electrode to form Copper Sulphide. Therefore, the bottom Cu-CdS junction would become a Copper Sulphide–Cadmium Sulphide heterojunction. The switching and memory effects could be attributed to either the Copper Sulphide (which is a chalcogenide) or to the properties of the Copper Sulphide-Cadmium Sulphide heterojunction.

Copper Sulphide thin films have been found to exhibit an electrical conductivity change in the 70–80° temperature range, which has been found to correspond to a phase change in Copper Sulphide in that temperature range. However, further experimental data, expecially low temperature measurements, seems to suggest the heterojunction of Copper Sulphide-Cadmium Sulphide could have some influence.

At the present time, the phase change in Copper Sulphide and the properties of the Copper Sulphide-Cadmium Sulphide heterojunction are believed to be responsible for the switching and memory effects observed in Cu-CdS-Cu (or Au,In) structures.

R. CCLE

**Gastamp**

The "gastamp" is a high energy rate forge with a conventional configuration platten press driven to closure at velocities near 65ft /sec. by the combustion of butane gas initiated by a spark plug.

B.F. DOWNIE.

**Heat Transfer Promotion by Jet Impingement in Forced Convection Tube Flow.**

Turbulence in a stream of air flowing in a tube is often directly related to the amount of heat which can be transferred to that stream from the heated tube wall. Jets of air directed radially outward, towards the heated tube, have been found to introduce the necessary turbulence for substantially raising the rate of heat transfer. This system was entirely developed at this University. Possible applications of the system lie in the nuclear power reactor field, where the highest possible rates of heat transfer are demanded, for largely economic reasons.

P.F. HOPWOOD

**Metal Forming With Pulsed Magnetic Fields**

Electric current carrying conductors exhibit forces between them, a phenomenon used in most electrical machines. If the currents are high the forces produced overcome the elastic strength of the conductors and physically deform them.

The magnetic forming technique uses short, very high current pulses obtained from capacitor storage banks to shape metal parts, either in free form or into discs.

Research into the process includes measurement of high current pulses and workpiece deformation rates in a period of about 50 micro seconds.

The work being undertaken at this University is concerned with correlation of experimental data obtained on the "Gausstamp" test facility and results predicted by computer simulation studies.

L.O. KIRKHAM

**A Wheelchair Pneumatic Control Unit for Quadriplegics.**

This project is concerned with the design of a control unit for a wheelchair which can be operated by sucking or blowing into a single mouthpiece. The control unit allows the selection of the following operations:-

Forward or reverse direction
Slow or fast speed
Left or right turn.

The operator selects the different operations depending on how hard he sucks or blows. The signal from the operator is amplified, and according to its magnitude connects the air supply to one of several cylinders which select the various operations.

The control unit is now to be mounted on a wheelchair and experiments carried out on the efficiency of operation and the effects on the operator.

L.J. SCOTT

**Steady State Heat Transfer from Right Rectangular Cooling Fins.**

This project is concerned fundamentally with improving the rate of heat transfer from a hot surface to a cooler fluid flowing across the surface. The placement of metal projections or fins on a hot surface to improve heat transfer has been in practice for many decades. Over this time a considerable amount of experimental and mathematical research has been carried out to predict theoretically the performances of many types of fin. Much of the mathematical work so far attempted has been very inadequate, because it has been based upon unrealistic assumptions about many thermophysical properties associated with both the fins and the cooling fluid. The present project is an attempt to set up a much more realistic mathematical model for fins, and it also includes experimental work to investigate the nature of variation of some of the thermophysical properties mentioned above. These experiments are being carried out in a specially developed heat transfer rig. Major applications of cooling fins include air-cooled engines, heat sinks for electronic devices, air-conditioning cooling coils, and finned fuel cans in nuclear reactors.

J.J. STURMAN.

**Computer Generated Cockpit Display**

The pilot of a modern jet aircraft uses basically the same instruments as pilots of aircraft in the early 1930's. Initially instruments were used to supplement human senses; today they are being used as substitutes for human senses even though they were never intended for this. The growing accident rate due to human error arising from increasing load on pilots of aircraft indicates the urgency of changes on the flightdeck.

The use of airborne computers has enabled more sophisticated cockpit displays to be developed as alternatives to conventional instruments. The display developed here is an alternative that could become a pilot's primary source of flight information. The line drawing is generated by the computer and may be viewed superimposed on the view of the outside world from the front cockpit window.

The PDP-6 computer has been adapted as a flight simulator to demonstrate the usefulness of the display. MMA jet pilots have successfully "flown" the stimulator in spite of the many shortcomings of the equipment. The project has mainly involved psychology and computer programming; the philosophy of engineering overrides the more fundamental aspects of either field. The favourable reaction of the pilots has created the incentive to continue the development of the display which appears to be, in principle, unique.

J. TREVELYAN

It was born on the day of an earthquake (Oct. 1968), and like some disturbances, it catches you! I'm talking of my Beach Buggy.

The original small windowed VW shell and running gear was found a little worse for wear but a bargain at $24.00, less motor. Once the bug had been captured, an unsuspecting friend lost his backyard to a storage-come-workshop conversion. This served my purpose for a year or more.

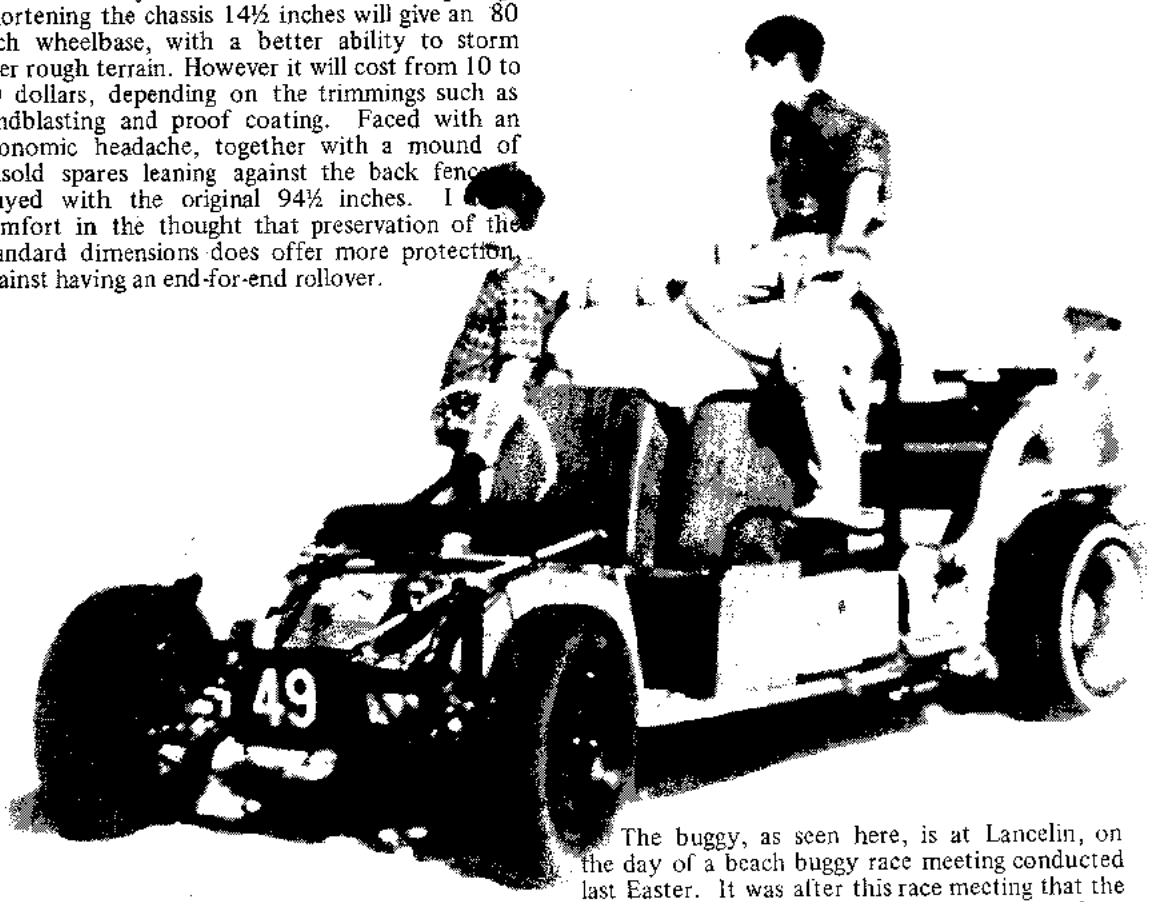
First stage, in preperation for the Beach, was to remove the body from the subframe; easily accomplished with a few willing pairs of hands, large quantities of an antirust formula and a little commonsense. At one point, an attempt was made to remove the top with a few crucial bolts still hanging on.....Ugh! Now, with the shell lying on the ground, it is suggested to spend a little extra time salvaging and selling unwanted body panels.

Stage two; Here a decision on the length of the subframe was made; a balance between driving manoeuvrability and construction simplicity. Shortening the chassis 14½ inches will give an 80 inch wheelbase, with a better ability to storm over rough terrain. However it will cost from 10 to 90 dollars, depending on the trimmings such as sandblasting and proof coating. Faced with an economic headache, together with a mound of unsold spares leaning against the back fence, I stayed with the original 94½ inches. I take comfort in the thought that preservation of the standard dimensions does offer more protection against having an end-for-end rollover.

Stage three, the 'last act', was a tour of the salvage yards; wherein suitable pipe was found, bought and transported to 'that backyard'. This stage was the hardest, mainly because a number of grandiose ideas had to be blended into a final design. From paper and pencil to a hired arc welder, I found that many ideas seem to be lost, but eventually the steel work was completed.

To the machine, a gallon or two of lime green paint was splashed about, and a 36 H.P. 'set of herbs' was bolted to its tail; my first buggy was born.

The first paint was still drying when with hired trailer and numerous friends; the buggy saw its first sand dunes. It was a good weekend. Continuing on in this tradition through the addition of wide rims, competitive racing and two shoestring body rebuilds, the original buggy gave only its best, rolled up in lots of fun and experienced gained.




The buggy, as seen here, is at Lancelin, on the day of a beach buggy race meeting conducted last Easter. It was after this race meeting that the buggy was sold, giving way to the planning of my latest wagon. This machine will wear a fibreglass body of my own design, suitable for licencing. At this time it is in the 'thirdstage', though soon to be a winner.

**DONALD YATES**

# UNI. ENGINEERING: AN EDUCATION?

The Engineering graduate of 1970 is entering a society in which his chosen profession has a fundamental role to play. Modern technology may provide the basis for progress in industrialized countries, but the concept of progress is being subjected to increased public scrutiny.

We must therefore examine the university degree course to determine whether it provides an adequate preparation for the professional engineer.

An engineer is expected to have a certain level of technical knowledge and analytical skills, coupled with the ability to rationally consider a problem. This is only one requirement for the engineer in industry, but on this area the present university course concentrates almost all of its attention. Engineering in History 40 (which might more aptly be entitled 'Engineering in Society') is the only compulsory non-technical subject which gives the student the opportunity for both self-expression and consideration (in group seminars) of the wider impact of engineering.

The question then arises as to whether an engineering course can really be considered a university education. For the first three years of study, the student is subjected to a one-way information flow which leaves far too little time for interpretation of the facts or more detailed examination of points of personal interest. Faculty Hour sessions provide the only opportunity within the formal context of the course to relate to wider experience.

Emphasis in the fourth year of study is more on the professional aspects of engineering, with Final Year Seminars and Engineering in History 40. Students also may elect to study a unit in another faculty. This provides an opportunity for enrichment in education which should seriously be considered by all students. Contact with undergraduates of other faculties can lead to an exchange of ideas and viewpoints, and interpretation of the role of engineering from a different basis. Selection of a qualitative subject also gives the engineering student some much-needed practice in written expression. The importance attached to these so-called liberal studies in overseas technical courses may be guaged from an article by Professor Wood in The Journal of The Institution of Engineers, Australia (April–May, 1969). In the U.S.A., for example, liberal studies occupy (on average) about 15 percent of allotted class hours. Special departments have been set up for this purpose in universities such as M.I.T.

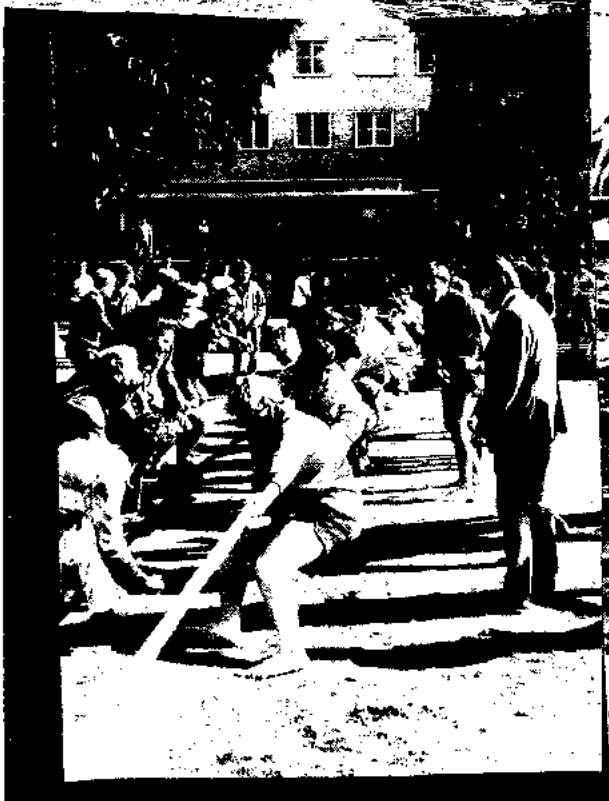
The ability to communicate effectively with both colleagues in his profession and those outside it is vital to the engineer. The present university course relies on laboratory reports, final year Seminars and Engineering in History to develop the student's written and verbal capabilities. No specific subject covering the preparation of reports is included in the curriculum in contrast to some of the American universities. When complaints about semi-literate engineers are commonplace, the need for more positive action in this regard should be evident.

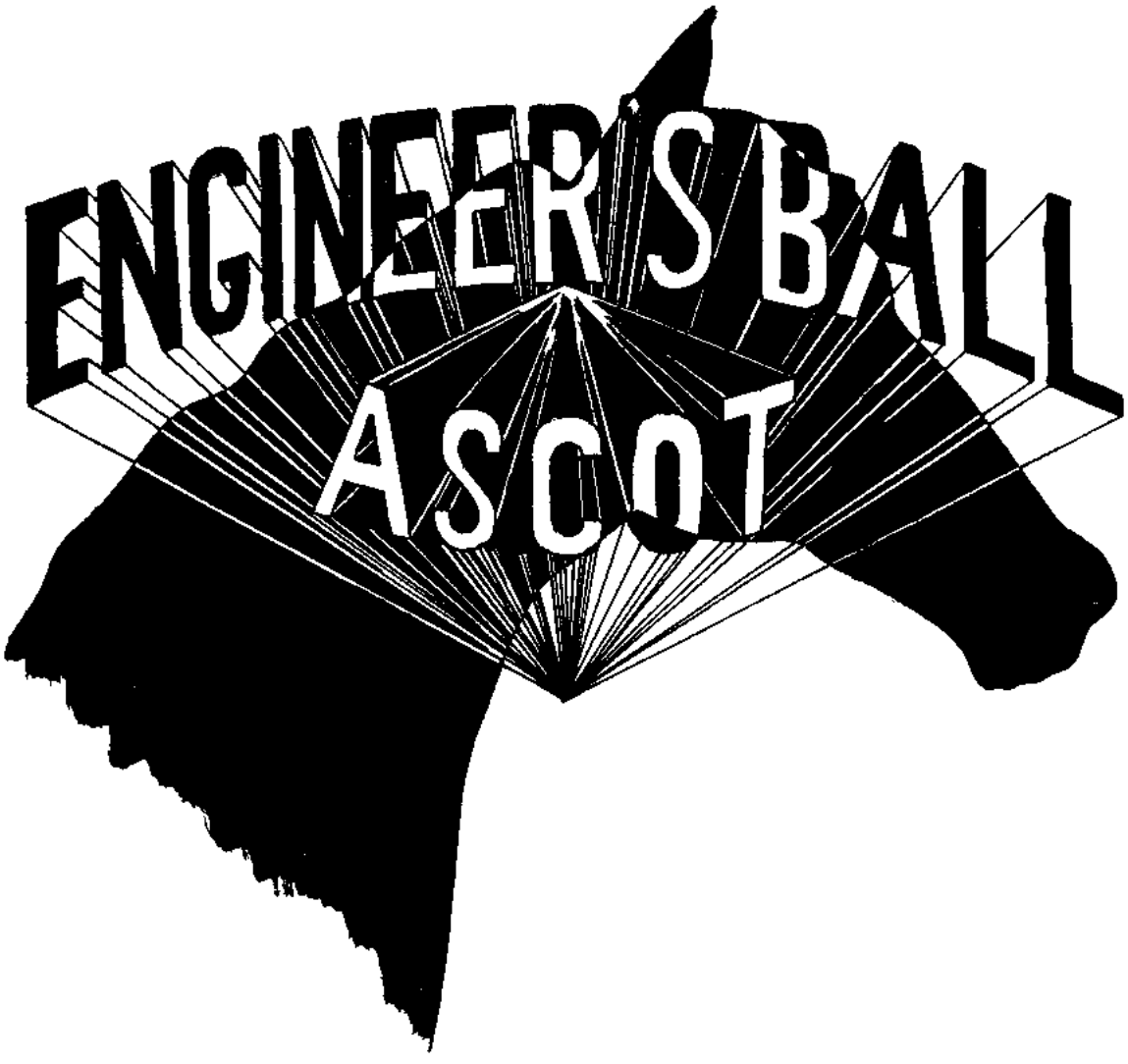
The engineer in industry must be able to communicate both with Management (who may be accountants, not engineers) and with workers on the shop floor or construction site. To be successful, he must be able to understand the language and objectives of both. Liberal studies of practical interest to the engineer therefore include basic economics or accountancy and the nature of industrial relations. Either will help to provide the broader understanding of engineering which is desirable in a university education.

Finally, the engineer must be encouraged to communicate more effectively with the community at large. The university graduate should be aware of the important social issues, and willing to use his knowledge to help formulate solutions. If the Engineering profession does not exert its influence on the political decision processes, it is in no position to complain about seemingly irrational solutions to social problems created by the industrial system.

The aim of a Bachelor's degree is not to provide a highly specialized education, but to form a general basis for more detailed study if so desired. Only a small percentage of graduates enter the research field; the great majority find jobs in industry. The university must equip the latter with a broad education to cover more than the purely technical aspects of their jobs.

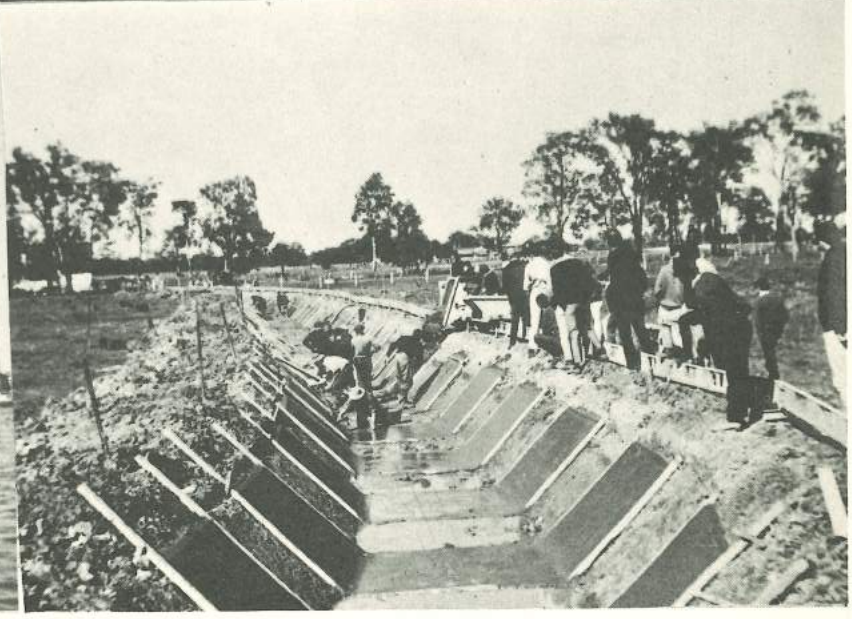
**P.J. PATTERSON**
**Mech. IV**






**JUNE 10**

# YEAR NOTES

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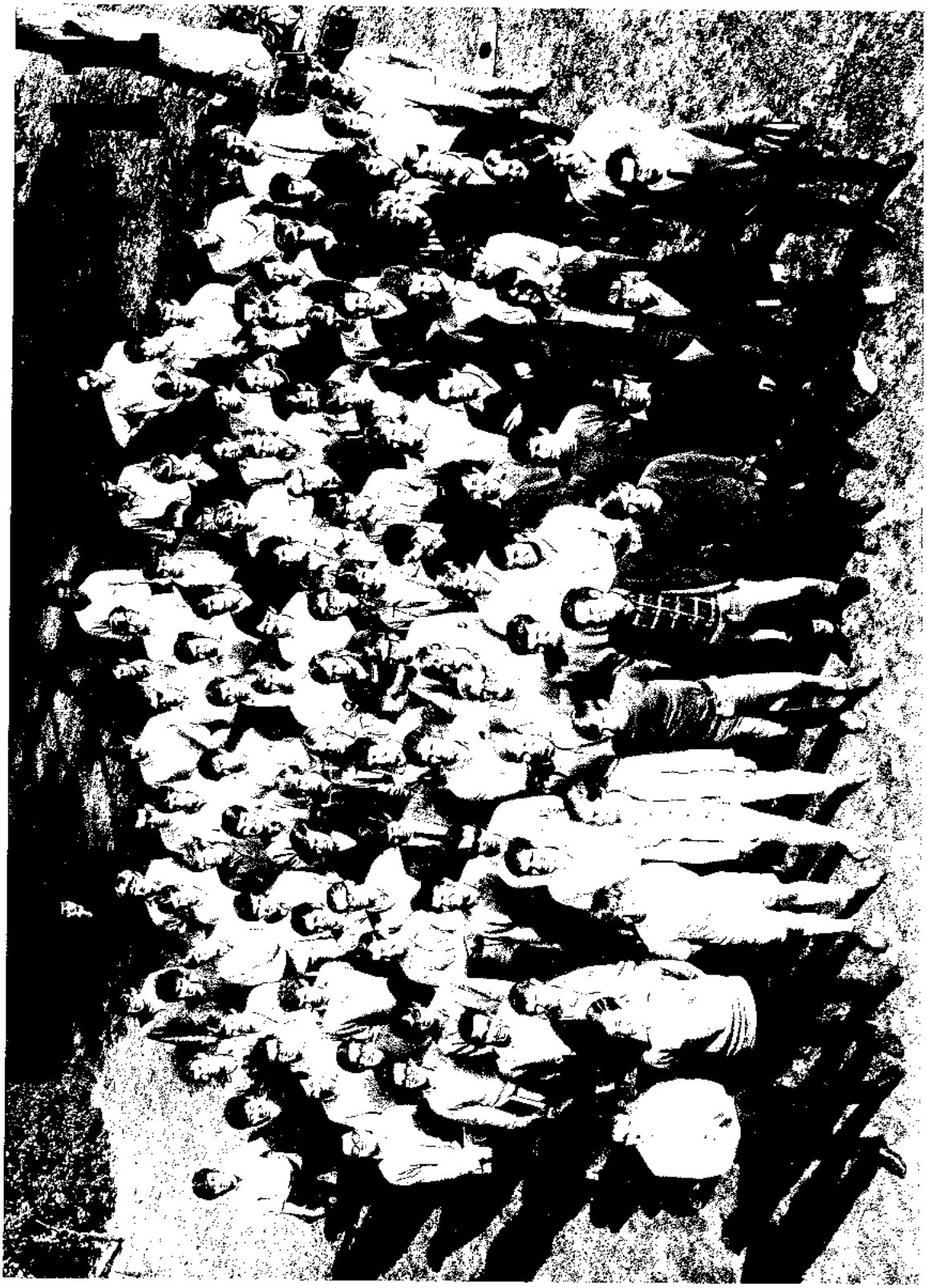


*M. Tarca, W. Edwards, B. Nilsen, G. Properjohn, D. O'Connell, J. Naunton, K. Chang, N. Cinquina, A. Jayasuriya.*

*A. Priolo, B. O'Leary, G. Edwards, C. Pollett, R. Candy, K. Lynch, M. Appelt, K. Ang.*

*R. Smith, G. Milward, R. Hale, J. Cox, J. Greenwood, L. Walker, D. Crawford, R. Johnston, G. Abbott, R. Becu.*

*C. Fitzhardinge*

## THIRD YEAR CIVIL

GREG ABBOTT
Leads a monasterial existence.

KENG ANG
Asian mastermind organising Oriental evening and inventing the palmalyzer.

MARK APPELT
Exchange cards with the Minister for National Service. Honours thesis is on stability of plates.

BOB BECU
"Buries" everything from bull-dozer to basketball players.

RUSS CANDY
After mumps, food poisoning, and having his car stolen, he capped off the year by getting married.

CHIP CHALLENOR
The K.W. Dart has carried everything from yellow stickers to 8-balls.

CHARLIE CHAN
Had difficulty pronouncing schist.

ALEX CHANG
He came back to Brylcream.

NICK CINQUINA
Honours thesis on reinforced concrete tomato stakes.

JOHN COX
Boundry layer. Known to say more in a lecture than the lecturer.

DON CRAWFORD

His fringe benefits keep everybody up to scratch.

DES DAVID

India-rubber man. Plays soccer like he has fingers on his feet (missing link).

LANCE DEEGAN

When not in the D.O. extracts conundrums from Scientific American.

GEORGE EDWARDS

Broke his arm parking his bike on a car bonnet. Tried to grow a beard with twenty hairs.

WALLY EDWARDS

Slowly appreciating structures.

ROSS FARRELL

His car has everything except a hair dryer.

CHRIS FITZHARDINGE

Bikie with a literary bend (Sinister). Two pot singer.

GUS FORMATO

Displayed the gutless fashion at the Dinner with his bird.

JEFF GREENWOOD

Believes in long sights on long legs, especially in the direction of the library.

RAY HALE

Turned 21 at the Dinner and spent the evening keeping his head above water.

DAVE HEWETT

With Merv, runs the C.M.F. Highly pampered.

GREG HUNT

Enjoys "folk" like Gorton. Will wear an R.S.L. badge where the Moratorium badge now resides.

MERV HUTTON

Suave sports-coated student. Had a ball this year. Close second in Marriage Stakes.

ALF JAYASURIYA

Is still returning reserved books.

BONNO JOHNSON

The feathered fighter refuses to head high-balls.

BERT LINDEN

The pen is mightier than the V.W..Amateur electrician till he got stung.

KEITH LYNCH

Took the steel prize with an 87 page design. He will use the money to buy another brown sports—coat.

DAVE MC.DONALD

Phantom student. Rumoured to have been sighted at Prosh.

GREG MARTIN

Scarborough surfie. Is in the process of fitting yellow doors to his board.

GRAHAM MILWARD

Thinks D.C.A. stands for Drink Cold Ale. Ran the Airport out of its Orbit Inne.

JOHN NAUNTON

Wanted lay-back seats for his ute but had to leave them erect.

BIRGER NILSON

Will set up in opposition to Ansett. Flies 747's these days.

DAN'L O'CONNELL

Kept Sack's lectures accurate to 7 figures.

BERNIE O'LEARY

Banished to the Institute.

GEORGE OSSOLINSKI

Became Sack's pet pupil when he mistook a tilting level for a dumpy. Only scratch golfer with a see-thru mo.

IAN PINEIRA

Shares everything with Farrell. Favourite counter lunch is knotted Phyllite Schist.

CHRIS POLLETT

Briefcase carrying-bow-legged soccer player.

TONY PRIOLO

After his first effort at mixing concrete decided to stick to grano work. Tried hard to keep up with Nick.

GEOFF PROPERJOHN

With his bird, was taken in by the Palmalyser. Working on longitudonal r/f for his nose.

LOU RHO

Had his concrete design in before the problem was set. Eclipsed by Nick's buffoonery.

NICK SALLUSTIO

Believes every girl should have an Italian love affair – in a Holden.

SMITHY

Following his father's interest in fluids.

MIKE TARCA

Drives a Holden in mint condition. Discovered that squash and cross country don't mix.

LOCH WALKER

The bearded basketballer. Shirt-fronted half the cleaning staff on the way to Surveying.

BALME

Bodywork by Swan.

BROWN

Marks exam papers with a geologist's hammer.

CLEGG

Threw the book at us.

COLE

Writes like his glasses were twice as thick.

COOPER

".....on the whole the fellas don't have the girls up."

MASSEY

"..... the four is more likely to be there than not."

MINTON

O.K. words and units of abdomens per square mile.

REYNOLDS

".....soil mechanics is all fairy tales."

RUEBEN

"..... don't screw with brute force and ignorance."

*R. Eddington, P. Andruszkiw, K. Loh, K. Chan, A. Usman, S. Ng, P. Blennerhassett, K. Collins.*

*H. Lau, B. Taylor, R. Dunstan, B. Douglas.*

*G. Hesford, J. Eattell, J. Barrett, P. Ginandjar, H. Tey, J. Basuki, D. Raymond, R. Maloney.*

## THIRD YEAR MECHANICAL

ALLAN

The married man of the group, likes smoking a pipe while he designs.

ANDRUSZKIW

A quiet guy whose perserverance can be judged by the fact that he alone attended Statistics tutes in second term.

BARRETT

A keen horse racing follower who always has the inside information but never seems to to back a winner.

BLENNERHASSETT

Always had the answer before the question was put.

COLLINS

Spent the year waiting for a slow boat from London which was reputed to have a young lady of particular interest on board. One of the many nice guys in the class.

DOUGLAS

Bruce's smooth looks were only matched by his desire to talk about his vast wardrobe.

DUNSTAN

An enthusiastic student whose willingness to participate throughout the year made life more interesting for all.

EATTELL

One of the motor-cycle brigade. Well known to Dr. Wager in Industrial Engineering lectures for his 'bikey habits'. Spends his spare time running with the Melville Athletic Club.

GARDNER

Rarely sighted at the latter stages of third term. Thought to have been working furiously elsewhere. Not a man to be taken lightly - runner up to the Australian Champion at the National Judo Championships.

HESFORD

Well known for his association with the fairer sex - enough said. Keep at it Geoff. For whom the bell tolls?

MALONEY

Carries his own stick of chalk. Excels in baffling the lectures.

RAYMOND

Drives a Cooper 'S'. One of the strong, silent type.

SPENCE

President of the U.E.C. - the number one man. Sighted in lectures only if Sue is not around.

TAYLOR

Another one of the quiet group. Became famous over night when he designed a baffling speed control device.

CHAN

Always talking, though most interesting. Takes an active interest in student affairs and in this field his 'bush lawyer' tactics are immediately obvious. Likes nurses.

EDDINGTON

Broke all rules by wearing a tie to lectures. Despite dabbling in politics still managed to play cricket.

YEO

Thinks big money-wise. Devoted disciple of the profit-loss principle. Appears only for more important lectures.

TEY

A fanatic for stress analysis and detail. Has great faith in his lecturers and particulary in female accountants from Ipoh.

USMAN

Always laughing, always happy, His lack of height was compensated for by his engineering ability.

GINANDJAR

Quiet and efficient. Complains that he never understood statistics, but never worried because no one understood it.

BASUKI

Worked on steadily unworried by his noisier class-mates.

LOH

Another of the motor-bike squad, although he flies a smaller prototype. Quick to comment, always ready to discuss.

NG

The class cowboy who rode his bike once too often. Gets his own back on the badminton court.

LAU

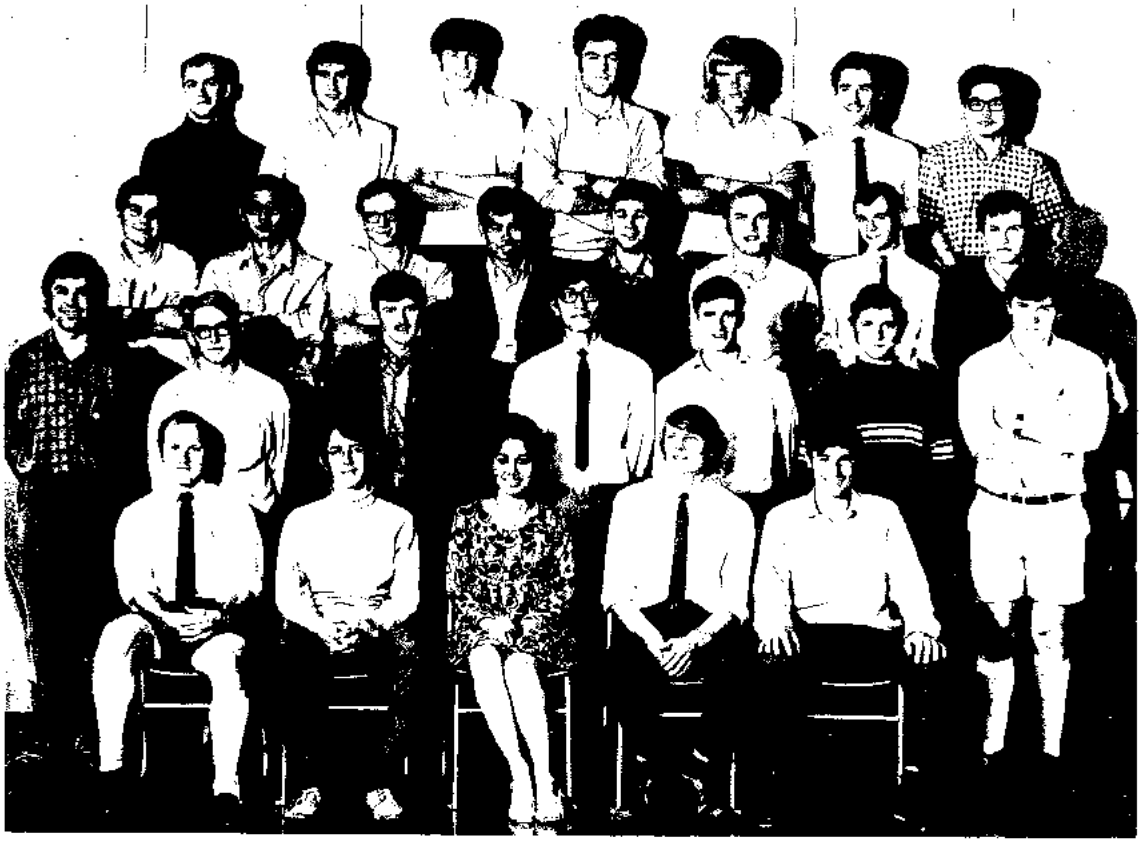
The quietest of the group - Never speaks always smiles.

TREESUWAN.

The T.V. fanatic. Can tell you any programme's viewing time. Dislikes Fluids but not fluids.

GOH

Champion table-tennis player who has been known to sleep through the morning lectures Smokes Camel - stunted his growth.



*D. Pryce, F. Tanner, P. Sargent, B. Toffoli, J. Uusioja, A. Stephens.*
*B. McKimmie, A. Choong, P. Knox, A. Aw, B. Burton, A Gobolos*
*P. Grey, G. Tytherleigh, R. Thornton, J. Leong, D. Pearce, J. Mason*
*D. Nicholson, J. Macpherson, I. Noridah, M. Burr, P. Morgan.*

## THIRD YEAR ELECTRICAL

ALLEN
Good to see he is still with us.

AW SOO
I'll kill the dirty rat that named me Soo'.

MIKE BURR
'Wheres Jenny? or 'What are we doing in lectures these days?'

BURTON
Certainly no actor when it comes to working.

TOM CHONG
Can I borrow Mondays lecture notes? I missed them again.

GOBOLOS
He worries more about what he's not worrying about than what he should be worrying about.

PETER GREY
Built transistors with a gain and again and again. Can't afford to made a mistake at his age.

HARVEY
Inhabits a pair of blue jeans and long hair.

JOCK HOWE
E107's nature lover, he spends the weekend spotting birds.

KHIO
'I think so. I am not sure about this.'

PETER KNOX
Knox knox - who is there? Let me in for Pete's sake.

JAMES LEONG
Practices his forward smashes in question time.

STEVE LIBLICH
Speeding towards fourth year.

JOHN MACPHERSON
Bassically soung.

MASON & MORGAN
A couple of physical jerks.....sweating it out in P.E.

MCKIMMIE
He's no dumbell when it comes to weighty problems.
DAVE NICOLSON
E107's fairy grandmother.
NORIDAH
The quiet princess.
DAVE PEARCE
Often found paralytic in remote areas.
POEJES
E107's communications tuner
DAVE PRYCE
Agent for Chinese notebooks.
QUAI
A Russian spy here to learn the in laboratory management.
PAUL REED
The devils answer to sobriety.
SARGENT
Could he be the only private Sargent in the army.
OLLY STACY
Engages himself in front-line nursing. Also our saviour from long hairs and subversions.
ASH STEPHENS
He's continually killing programmes and students.
SUBROTO
Ah! You didn't go to the tute.
TAN
'Excuse me! Shouldn't that be.....'
TANNER
Ready to stop work at the wink of an eye. Tanner than Tan.
THAM
'Might as well forget about it.'
THORNTON
Wouldn't make the R.A.F. with that mo.
HARRY THREFFFFALL
Unlike his spark plugs he does miss occasionally.
TOFFOLI
Every little bit counts.
TYTHERLEIGH
Kiwi with specs appeal
UUSIOJA
Continually applies his wave theory.
VAN DE RUIT
Sees the world through a fish-eye lens.
DAVE YEE
Dress impeccable as his attache case.

LEARY
Seems to find easy the correlation between prac. classes and concentration camps.
FALL
Takes the prize for best dressed lecturer. However he can be too formal on occasions.
MILLS
Appears to have his tutorials worked out rather well.
SPITTEL
A good squash player but leaves his energy on the court rather than on the board.
BUNDELL
Favourite sport - shooting.
BRADFORD
Student - 'Shall I use a OC71 or an AW 1150?'
Bradford - 'YES that's right.'
BILLINGS
Has been known to go sour on the 109th component of his generalised compliance. Nevertherless is a scholar and a gentleman of the fourth order.
NASSIBIAN
Battles bravely with Physics Honours students.

*L. Zekas, R. Griffiths, J. Roberton, C. Burton, S. Wade, D. Warnock, P. Nadebaum, G. Elderfield, B. Laughton.*

*J. Crow, M. Croy, R. Leonhardt, R. Clarke, T. Watanatada, R. Harvey, G. Cocks, P. Brearley, J. Massey, D. Faigenbaum, A. Kay, C. Nguitragool, J. Wyche.*

*Mr. P. Minton, R. Dimond, C. Condipodero, D. Glenister, R. Hammer, C. Thum, R. Banyard, L. Davies, J. Caro, A. Smith, L. Neish, Mr. D.M. Devenish.*

*Mr. S.J. Thomas, Prof. R.A. Ansley, Dr. B. Clegg, Mr. J.R. Espie, Prof. K.L. Cooper, Dr. P.C. Massey, Mr. H.S. Craddock, Mr. J.H.B. Matthews, Mr. N. Moffat, Mr. J.J. Van Der Meer.*

## FOURTH YEAR CIVIL

ZEKAS
Fi..t on a list for a change.

BANYARD
Finally broke the ice.

BURKE
A brick and tile man.

BREARLEY
Soon to retire, a grand old fellow.

BURTON
Selected by his classmates as the boy most likely to succeed.

WYCHE
No comment.

CLARKE
Big strong silent type.

CROY
Has a way with the women.

CONDIPODERO
Cassenova, given half a chance.

COCKS
Dabbles in the surf.

CARO
Plays "classical gas"

DAVIES
Adores his motor-bike

DIMOND
Reached magnificient heights in Bridge 40 and Darts 30.

ELDERFIELD
Ah be buggered.

FAIGENBAUM
Loves ELSE.
GRIFFITHS
Dislikes barbers.
GLENISTER
Down to earth, still a keen surfer.
HAMMER
An ecclesiastical bag carrier.
HALL
Always a gentleman.
HARVEY
Sauve in sunglasses.
KAY
Nearly always a gentleman.
LEONHARDT
Thinks he's Governor-General
MARGETTS
Finally turned the lights out.
MASSEY
The donor of the John Massey Memorial Chess Board.
NEISH
Quiet and studious.
NADEBAUM
Pronounced "Noody Bum", grew hairs on his teeth during the Gledden tour.
NGUITRAGOOL
No girls are safe.
ROBERTON
A solid citizen, passed his Nasho's medical.
SMITH
A laugh a minute, "Begoda Bejesus."
THUM
Tom
LOUGHTON
"Tubs", conscientious.
WARNOCK
Should have been a poet.
WADE
"Whimpy", appreciated by everyone.
WATANATADA
The wild man of Bangkok, a "Tycoon".
CROW
Passed.

*P. Paterson, M. Cliff, T. O'Brien, J. Modra, F. Barker, L. Hoffman, T. Harvey*

*D. Humphries, M. Lau, A. Maluish, K. Chong, K. Chia, W. Fok, M. Chinniah, J. Blackbrorrow*

*K. Koh, G. Simpson, A. Blaquiere, K. Foong, V. Tinh, S. Lim*

*Dr. J.G. Wager, Mr. J.S. Tan, Mr. M.B. Widden, Mr. J.A. Cole, Prof. D.J.F. Allen-Williams, Mr. G.G. Lutz, Mr. R.S. Minchin, Mr. R.C.R. Johnston, Mr. R.B. Noyes.*

## FOURTH YEAR MECHANICAL

MANO CHINNIAH

An honours student without the killer instinct to really slay the examiners.

JEFF CHONG

The only Asian on campus who can grow a moustache of more than half-a-dozen whiskers. Exams affected his reason and he shaved off his status symbol.

MIKE CLIFF

The supreme optimist, Mike used to race a stock 1959 V.W. at Caversham.

FRANK BARKER

The only surfer to make it through in the allotted time. Frank will be working in Melbourne in 1971. There's not much surf (or sun) over there, Frank.

JOHN BLACKBORROW

Suspensions and spearfishing his forte. Off to Geelong with Ford – plenty of suspensions but light on spearfishing.

ARTHUR BLAQUIERE

Alias Slaquiere; Arthur is seeking the answer to the question "How slack can a fourth year be and still pass?"

FOK

Won the engagement stakes from Les Hoffman and John Blackborrow by a short nose (ever seen an Asian with a long nose?).

KEN FOONG

Quiet and efficient. Truly fits the 'Engineers' motto of doing and not talking.

TREV HARVEY

Must be the keenest stude alive – spent two weeks on his honours project after the exams voluntarily.

LES HOFFMAN

Eats, sleeps and breathes study. Had a week-end in Melbourne in second term and returned engaged. Another one of the "doers".

DOUG HUMPHRIES

Either schizoid or paranoid. Has a fantastic ability to spend 24 hours solid in the D.O. the day before design assignments are due.

KOH

Another one of our keen studes. His plans for doing post-grad were foild by Nashos. Enjoys himself in spite of the work he does.

LAU

Tin miner from Malaysia. Will be working for Shell in Singapore. The spoken word is mightier than the written.

LIM

Believes in being seen but not heard – most of the time. Is he really a racialist or is he only fooling?

ANDY MALUISH

Another spearfisherman, Andy has the remarkable ability to do a complete design in two days. All his sports encompass liquids in some form.

JOHN MODRA

A middle aged bikie, John has more qualifications than you can poke a stick at. Off to Melbourne and Caterpillar Australia in 1971.

BOOTS O'BRIAN

His designs were so good that several were "borrowed" one way of avoiding finishing them. Future employee of Ford Australia.

PHIL PATERSON

Coming from a long line of car lovers – Rover 2000, Lotus Elan Cooper 'S' – Phil will not be joing Ford. (Is that significant?)

GEOFF SIMPSON

Another unmotivated student and one of Maluish's fellow elbow benders. Fun and Uni do not go together very well in his eyes.

TINH

After five years at Uni, he faces a future in the Vietnamese Infantry. Still manages to smile though.

DR. WAGER

High stochastic probability of a tutorial becoming a lecture. Tutorial, lutorial, letorial, lectorial, lecture.

MR. MINCHIN

We only want social evils removed.

PROF

At the conclusion of a seminar; ". . . is the speaker aware that formula 3.13 on page 7 is not dimensionally homogenous?"

MR. COLE

Why must he always say, "I must say.....?"

MR. LUTZ

Referred to by the studes as "the old master." The old is obvious; the master refers to his lecturing.

DR. HEMMINGWAY

An expert in Thermodynamics and Egyptian heiroglyphics, he will occasionally translate what is on the board. Known as Dr. GTFPLPG (gas turbines for peak load power generation).

MR. WIDDEN

A Moratorium badge during Dynamics lecture; one of the concerned.

MR. TAN

Lectures do not necessarily start on the hour, nor do they conclude 45 minutes later; an exercise in student control.

MR. NOYES

"Any questions? No. Good. Here's the next problem sheet."

MR. CAIRNS

Witnessed inflationary pressures in design which resulted from an ultra-keen (??) group of students.

Memo received by the Janitor . . . . .

Chas.

Your prompt action is required. Department front nearside right hand front back door. Would be alright if we couldn't get in but we can't get out.

*G. Ferrero, A. Ali, A. Haime, P. Coronel, C. Tay, J. Ryan.*

*A. Tan, L. Luciani, T. Leung, M. Gilbert, M. Basell, M. Stojanovic, T. Fung, V. Power.*

*Dr. J. Mills, Prof. A.R. Billings, Dr. J.V. Fall.*

## FOURTH YEAR ELECTRICAL

The process of natural selection having done its bit only sixteen well spent electrical proteges struggled up the final limb of academic evolution. This was it, the professional year of the undergraduate degree course. Some of us had been thinking about it for quite some time PAUL CORONEL, for example, who had secretly considered himself a member of the profession in third year, and a professional for a much longer period, decided that now was the time to work on his second degree.

On the other hand this new found status had little effect on MAL BASELL, who opted for a different form of bridge bidding, nor for the ubiquitous A.S. TAN, who has still not uttered a word in jest. Similarly JOHN BLOODY RYAN took the path stride by stride.

This was the year of countless reports and theses. There was a strong rumour current that ALLAN HAIME'S second term lab report was longer than BILL FUNG'S thesis, but in the words of T.B.F.: "Who care?" MICHAEL LEUNG was a little more devoted, and as second term passed and the examinations loomed he could be seen scraping along in his sleep wrapped around two dozen tatty files, religiously seeking knowledge. One look at LUC LUCIANI would reveal whether the Six was up or down, and GRAEME FERRERO even relinquished his precious Guild just for the effort.

One of the dominating preoccupations of the unbonded members of our caste was a constant fossicking into the industrial wastelands in search of a benificent superannuation scheme. MURRAY GILBERT waxed from painting himself completely unemployable to being offered so many positions that he was unable to make a choice. No doubt MAK, of whom little is known and even less is said, will vanish into the inscrutable orient, as will TAY, still smiling after four arduous years. There was another vile rumour to the effect that STOJO has been elected chief signal-box attendant on the East Mukinbudin line.

RON CHANG defied all intuition and attended most lectures this year. This was undoubtedly FELIX SPITTEL'S swansong, to whom we all wish a most enjoyable career – in commerce. Numbed by the icy wit what? of The 'Good DR. LEARY', we almost missed the good oil seeping from the MILLS, and its mathematical compliment irradiated from ZIG.

There remains one member of the community as yet unmentioned, but we feel that so much has he impressed upon his image will remain indelible. Suffice it to say that since he joined the S.E.C. the entire system has failed on two occasions.

We must finally award two prises for continuing faith and courage. The 'Moulding our Hearts and Minds' award to the MASTER, and the Sparkalarkalarkaling Lecturer of the Decade to DR. BUNDELL.

# RULES FOR LOUSING UP A JOB

## Rules for Contractors

Assume that the engineer must be incompetent or impractical, or he would be in the contracting business instead, making as much money as you are. It is true that there are intellectual rewards connected with engineering not to be found elsewhere, but anyone who would pass up hard cash for anything as intangible as that is necessarily an idealist – that is to say, next door to a damn fool.

The lower the quality of work, the less it costs. Use that as an axiom, and fight the engineer for lower quality at every point. Don't believe any figures showing that good work costs no more. They're off. Figure that everything the engineer wants will be against your interests.

Take your time on the job; if you get stuck with an overtime penalty, you can always raise the devil about "unfairness."

Plans are only a basis for bids, and changing them merely a matter of altering a few lines. If you would like to have them changed to suit your methods of work, say so. It will help if you can point out where they could be improved upon. Every engineer likes to hear his designing department accused of incompetence.

If you want a change made which the field engineer has no authority to grant, tell him that really competent engineers settle such matters on the spot without stirring up any mud in the office. That will help. If you can kid him into risking his job, and violating his conscience, what of it? It It isn't your job, or your conscience.

If the engineer seems disposed to be friendly and reasonable, and to take you on trust, work your opportunity for all it's worth. Get by with everything you can while the getting is good.

If the man in charge is a graduate engineer of experience and reputation, your men should address him as "inspector". It will be good for his ego. Calling an engineer "surveyor", or making remarks about "S.I.s" will also help to create a friendly atmosphere.

## Rules for Engineers

Be sure to shine as an important figure in the eyes of visitors and outsiders. Don't hesitate to let everyone know what poor work the contractor would do if you weren't right on the job, and how your're 'making' him hit the ball.

Take advantage of the specifications to interfer with the contractor's methods as much as possible; never mind whether it makes any difference in the quality of the work. The main thing is to impress him with the fact that you are in control of the job.

When testing materials or inspecting work, be as officious and suspicious in your manner as possible; this will show the contractor that you are a live wire, and will add sporting interest by challenging him to slip something over on you.

When you have the occasion to explain a point in design, don't forget that all contractors are uneducated members of the hoi polloi; explain things loftily to them as you would to a child, in words of one syllable. This will make them like you. Another good method is to make yourself as technical and incomprehensible as possible, so that the contractor will be awed by your superior knowledge.

Assume that every suggestion the contractor makes must have a dishonest motive behind it.

When the contractor wants lines or grades, take your time. If you hang him up for a day or so, he will be impressed by the dignity of your position

If you get crosswise with your own office through some misunderstanding, don't explain, sulk instead, and tell everyone what a rotten deal you are getting. If you can, so that they will know you are a man of spirit. An air of injured and long-suffering innocence is another good bet– it gets sympathy.

Criticise the men and methods of your organisation unhesitatingly; people will appreciate that you are too big for your position, and you may be able to get a better job when fired.

# STUDENTS 1970

## FIRST YEAR

Ackland M.J.
Ang Leong
Armanasco P.S.
Atkinson M.C.
Baguley L.F.
Baker M.J.
Baker W.T.
Basanovic P.
Basell D.H.S.
Baster P.R.
Belford D.R.
Best D.B.
Black B.H.
Blackman J.E.
Blandford N.J.
Blood J.M.
Bower J.G.
Bradshaw K.J.
Britto C.F.B.
Brooks D.S.
Brown K.W.
Bryant I.F.
Butson K.R.
Calligaro R.H.
Canavan P.
Cantoni P.F.
Cargill R.D.
Caro N.W.
Carroll S. MacE.
Catto I.D.
Chan Bun Soon
Cheong Choi
Chew Hung Leng
Cheyne J.C.
Chong Fo Kui
Chong Fook Loong
Choong G.
Christensen C.H.
Chua D.T.C.
Chuah Teong Peng
Chung D. Chi Wai
Clarke A.E.
Clarke P.T.
Coate M.T.
Coghlan (Miss) R.L.
Collura S.
Cornish D.K.
Cosson M.G.
Cox F.S.
Crawford M.S.
Cullity D.T.
Cusmano F.
Davis C.C.
Davis P.F.
Denison G.G.H.
Denny I.C.
Desker P.E.
Djulbic E.S.
Dobson J.R.
Done M.E.
Dong Nhan Trung
Doropoulos J.
Doropoulos L.
Douglas P.C.
Dow M.W.J.
Dunn P.P.
Dunn R.W.
Eng Meng Swee
Fadersen (Miss) W.M.
Feeney P.A.
Finn M P.
Fitzgerald D.J.
Fitzhardinge M.B.
Fleay E.W.
Foo Choo Shong
Foo Seow Fong
Foreman L.D.
Fowler J.M.
Gadd C.B.
Gartner J.C.
Gibson A.J.
Gillett C.J.
Glasheen B.M.
Goh Chin Hua
Goode C.W.
Goulias J.
Govan J.R.
Green C.R.
Green T.W.
Greenwood C.G.
Grinceri A.J.
Gugich J.J.
Gummer A.W.
Hambleton G.N.
Hammond R.S.
Hardy R.J.
Harris I.R.
Harris P.M.
Harry S.P.
Hastings L.R.
Hewitt M.I.
Holt G.A.
Holywell D.K.
Honeyman A.D.
Hong Chhon Leong
Howlett I.D.
Johns G.S.
Johnsen M.T.
Jolly P.B.
Kelliher R.G.
Kelly A.J.
Kendall W.T.C.
King J.C.
King J.H.
Koh K.C.
Kong N.M.
Kooperman B.C.
Kost A.J.A.
Krishnasamy G.M.
Krutsky T.R.
Lalli M.A.
Landro C.B.
Lang G.B.
Larkins G.K.
Lau Geok Hong
Lau Kian Hwa
Lee Heng Yip
Lee Keok Wah
Lee Khoon Ming
Leivers J.
Leslie R.A.
Leung Chi Hong
Lewkowski G.J.
Lim Ah Ter
Lim Beng Yeow A.
Lim Jitto Boo
Lim Kok Lai
Lim Lee Chat
Lindsay D.A.
Lok Chuan Seng
Lukas F.X.J.
Lyons J.M.
Mackenzie P.L.
Madafferi S.
Malaspina P.
Manzi A.
Marocchi E.L.
Mattner P.L.
McAuley M.J.
McAuliffe R.A.
McMurdo R.V.
Medbury R.C.M.
Meharry D.S.
Miles J.R.
Millman J.A.
Mills A.M.
Modra K.C.
Mofflin L.H.
Mohamad Anuar S.
Ng Phillip Kah Meow
Nichols R.G.
Nicholson G.J.
Nieman H.F.
Nind E.P.
Noel R.F.
Norman M.J.
Noteboom F.J.
Ong Joo Hong
Orkney K.R.
Ovens J.W.
Ozarczuk T.S.
Packer C.
Papadopulos G.
Parisotto L.M.
Patrick N.
Pedrick W.G.
Penrose R.I.
Pensabene A.J.
Perreau M.E.
Pickersgill H.S.
Pike A.W.
Pirga S.M.
Platt J.M.
Plummer A.M.
Porter (Miss) J.L.
Porter T.G.
Prout J.S.
Puhl T.S.J.
Radaich J.P.
Raich Vlado
Ramsey W.J.
Rappeport L.D.
Rawlings N.F.
Reynolds M.L.
Roberts M.D.
Robinson A.M.
Rowe K.J.
Ruskulis A.J.
Ryan G.W.
Savill W.L.
Scanlon R.F.
Scarfe R.W.
Schladow G.
Schmidt D.J.
Seckington C.C.
Sellner T.B.
Shakhovskoy P.
Sheridan D.B.
Silvester R.S.
Smith B.J.
Smith M.G.
Smith P.J.
Stone K.A.
Tan Kiaw Ring
Tan Lam Pheng
Teh Thean Hong
Thanh Nguyen Hoai
Thomson W.G.
Toh Say Pheng
Trichilo F.
Turnbull G.A.
Unkovich I.T.
Van Dongen A.J.
Veale C.M.
Vigus C.L.
Voon Tai Chong
Wahab bin Hj Dolah
Walker R.D.
Wallace J.D.
Wang Jwh Wah
Watson A. McK.
Weaver I.J.
Webb M.R.
Wiley J.R.
Wilson M.W.
Wisitwatanawong S.
Wong Ching Kuok
Wong Nam Hua
Wong S.G.
Yong Tshe Liung
Zaknich A.
Zen A.
Zinkler A.S.
Ip, S.S.

## SECOND YEAR

Anekpuritanang T.
Ariyaprakai V.
Baker K.J.
Barnett P.B.
Barrow G.J.
Baynes L.T.
Blair D.R.
Bradley K.J.
Broadway G.A.
Budisuwito K.
Cabral D.
Canaway P.
Chandler I.J.
Chatjarernswad S.
Chen Y.
Chew K.C.
Chew Y.T.
Chuah L.H.
Chung A.Y.E.
Clarkson B.D.
Coffey P.S.
Cordin P.G.
Cordingley F.E.
Crisafulli C.W.
Darrigan P.R.
D'Ascanio A.
Dowling M.E.C.
Dundas G.S.
Edmonds L.W.
Elliott J.
Englund E.A.
Fitzpatrick G.M.
Foster S.G.
Gardiner C.K.
Goh V.C.H.
Gorman M.R.
Gow K.N.
Graham S.
Gray D.R.
Greenacre G.S.
Halvorsen S.M.
Hanafiah A.C.
Healey E.J.
Hemsley L.P.
Herd D.B.
Hillman M.O.
Hungspreug S.
Imms K.J.
Ingham C.T.L.
Kan T.S.
Kehoe J.D.
Lapuma S.L.
Law-Davis K.H.

## SECOND YEAR

Lemish P.J.
Letham C.D.
Liang B.H.
Limpaseni W.
Lindquist I.D.
Lodge K.L.
Longley J.F.
Lutton P.F.
Marchesani P.
Marks P.
Meyrick S.J.
Milne G.P.
Mitsopoulos V.L.
Montgomery J.C.
Morris W.J.
Nadilo K.B.
Neanchaleay K.
Ng H.H.
Nicholson R.K.
Olminkhof J.B.
Ong S.W.
Pascoe C.S.
Payne M.J.B.
Probert N.J.
Pugsley G.O.
Pullan D.A.
Pyburne S.P.
Rafferty G.F.
Reklitis M.
Richardson A.J.
Salter R.
Scott P.W.
Simpson R.N.
Stack P.R.
Stewart C.K.
Stewart I.D.
Storey P.J.
Strahan T.H.
Suwanvitaya P.
Tan B.C.
Taneerananon P.
Taplin P.N.
Thompson I.R.
Thorpe R.J.
Tresidder G.A.
Wake G.S.
Walker G.P.
Walsh P.G.
Walters M.O.
Waugh P.J.
Williams C.G.
Wong Cheow Kim
Wong Choong Kee

Carpenter R.J.
Chin E.W.Y.
Davis M.J.
Dee P.K.
Faraone L.
Ferguson R.C.
Fouracres T.J.
Georgakakos G.
Gibson R.D.
Giorgi M.
Griffiths P.R.
Kwan W.C-Y.
Liew S.L.
Maley P.M.
McNaught B.W.
Mounsher N.J.
Ng A.E.
Pang T.Y.P.
Piper A.
Plante (Miss) J.J.
Salled V.P.
Sallustio A.
Whiting S.N.

## SECOND YEAR

Chan J.P-K.
Chi J.R.
Clifton P.J.
Collett J.L.
Foster W.
Gell I.D.
Hirst J.C.
Ithisariyanont T.
Jarvis J.W.
Lansell S.V.
Ng R.
Oma G.L.
Rasjib H.
Scolaro R.J.
Southwell P.J.
Steele R.A.
Wasser P.
Wong K.L.
Yates D.
Young N.W.
Zambotti B.

## THIRD YEAR CIVIL

Abbott G.B.
Ang, K.L.
Appelt M.A.
Becu, R.D.
Candy R.I.
Challenor H.A.
Chan T.Y.
Chang K.S.A.
Cinquina N.
Cox J.R.
Crawford D.I.
David D.J.
Deegan L.
Edwards G.
Edwards W.J.
Farrell R.G.
Fitzhardinge C.B.
Formato A.
Greenwood J.M.
Hale R.W.
Hewett J.D.
Hunt G.F.
Hutton I.M.
Jayasuriya A.M.
Johnson R.
Linden A.H.
Lynch K.O.
MacDonald D.G.
Martin G.R.
Milward G.
Naunton J.F.
Nilsen B.O.
O'Connell D.
O'Leary B.K.
Ossolinski G.
Pineira I.M.
Pollett C.G.
Priolo A.
Properjohn G.E.
Rho L.A.
Sallustio N.
Smith R.B.
Tarca M.J.
Walker L.D.

## THIRD YEAR ELECTRICAL

Allen J.A.
Aw A.S.
Burton B.W.
Choong A.T.C.
Gobolos A.Y.
KcKimmie B.R.
Mason J.K.
Nicholson D.C.
Noridah Miss I.
Poepjes T.T.
Subroto W.
Tan W.S.
Tanner F.A.
Tham C.K.
Thornton R.G.
Uusioja J.

Baldwinson R.J.
Burr M.J.
Grey P.R.
Harvey K.F.
Howe R.J.
Khio S.
Knox P.R.
Leong J.T.K.
Liblich S.
Macpherson J.D.
Morgan P.W.
Pearce D.L.
Pryce D.V.
Quai D.
Reed R.P.
Sargent P.R.
Stacey A.O.
Stephens A.R.M.
Threlfall H.J.
Toffoli B.
Tytherleigh G. St.J.
Van de Ruit R.
Yee C.L.

## THIRD YEAR MECHANICAL

Allan D.E.
Andruszkiw P.
Barrett J.A.
Basuki J.
Blennerhassett P.J.
Chan, K.E.
Collins K.D.
Douglas B.M.
Dunstan R.J.
Eattell, J.P.
Eddington R.I.
Gardner P.E.
Ginandjar P.
Goh C.A.
Hesford G.A.J.
Lau H.K.M.
Loh K.K.
Maloney R.J.
Ng S.W.
Raymond D.J.
Spence R.E.
Taylor B.R.
Tey H.S.
Treesuwan S.
Usman A.K.
Yeo C.T.

## FOURTH YEAR CIVIL

Banyard R.E.
Brearley P.M.
Burke A.J.
Burton C.W.
Caro J.C.
Clarke R.K. (Miss)
Cocks G.C.
Condipodero C.A.
Crow J.G.
Croy M.W.
Davies L.M.
Dimond R.M.
Elderfield G.P.
Faigenbaum D.
Glenister D.J.
Griffiths R.W.
Hall G.L.
Hammer R.W.
Harvey R.A.
Kay A.
Leonhardt R.P.
Loughton B.J.
Margetts L.F.
Massey J.B.
Nadebaum P.J.
Neish A.J.
Nguitragool C.
Roberton J.J.
Smith A.G.
Thum C.H.
Wade S.N.
Warnock D.
Watanatada T.
Wyche P.J.
Zekas L.

## FOURTH YEAR ELECTRICAL

Ali A.L.
Basell M.C.
Chang C.L.
Coronel P.T.
Ferrero G.T.
Fung T.B.
Gilber M.J.
Haime A.L.
Leung T.H.
Luciani L.E.
Mak W.L.
Power V.F.
Ryan J.D.
Stojanovic M.
Tan A.S.
Tay C.N.

## FOURTH YEAR MECHANICAL

Barker F.D.
Blackborrow J.
Blaquiere A.H.
Chia K.W.
Chinniah M.
Chong K.P.
Cliff M.L.
Fok W.C.
Foong K.K.
Harvey T.S.
Hoffman L.S.
Humphries D.N.
Koh K.E.
Lau M.T.
Lim S.K.
Maluish A.G.
Modra J.D.
O'Brian T.A.
Paterson P.J.
Simpson G.P.
Tinh V.V.

WHAT'S IN IT FOR YOU?

Western Australia spends more than $1 million a week building and improving public roads.

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YOU

in the M.R.D. team.

Promotions depends on ability and merit.
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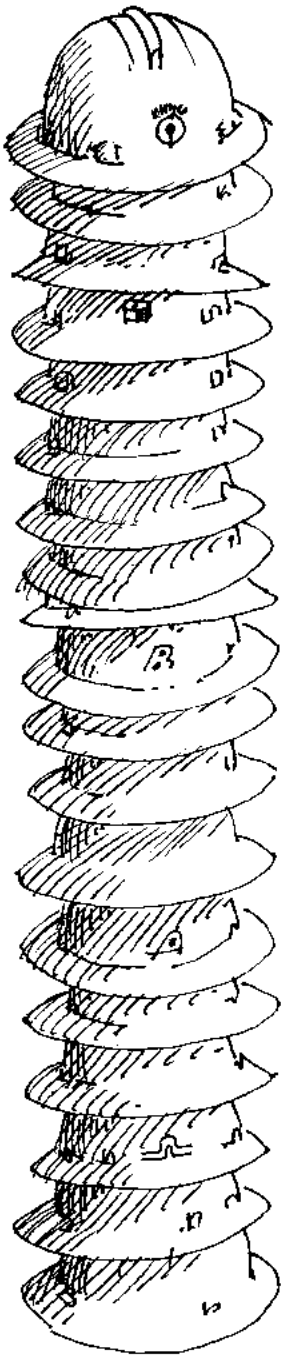
Enquiries: The Secretary, Main Roads Department, Perth, 6000.



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For another, you'll be taking your place in a big, vigorous company that never stands still. Engineers have always played a major part in BHP's expansion.

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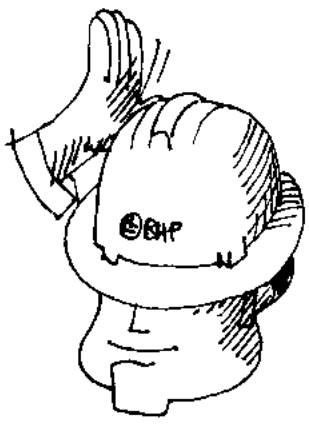


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